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Type 74-19

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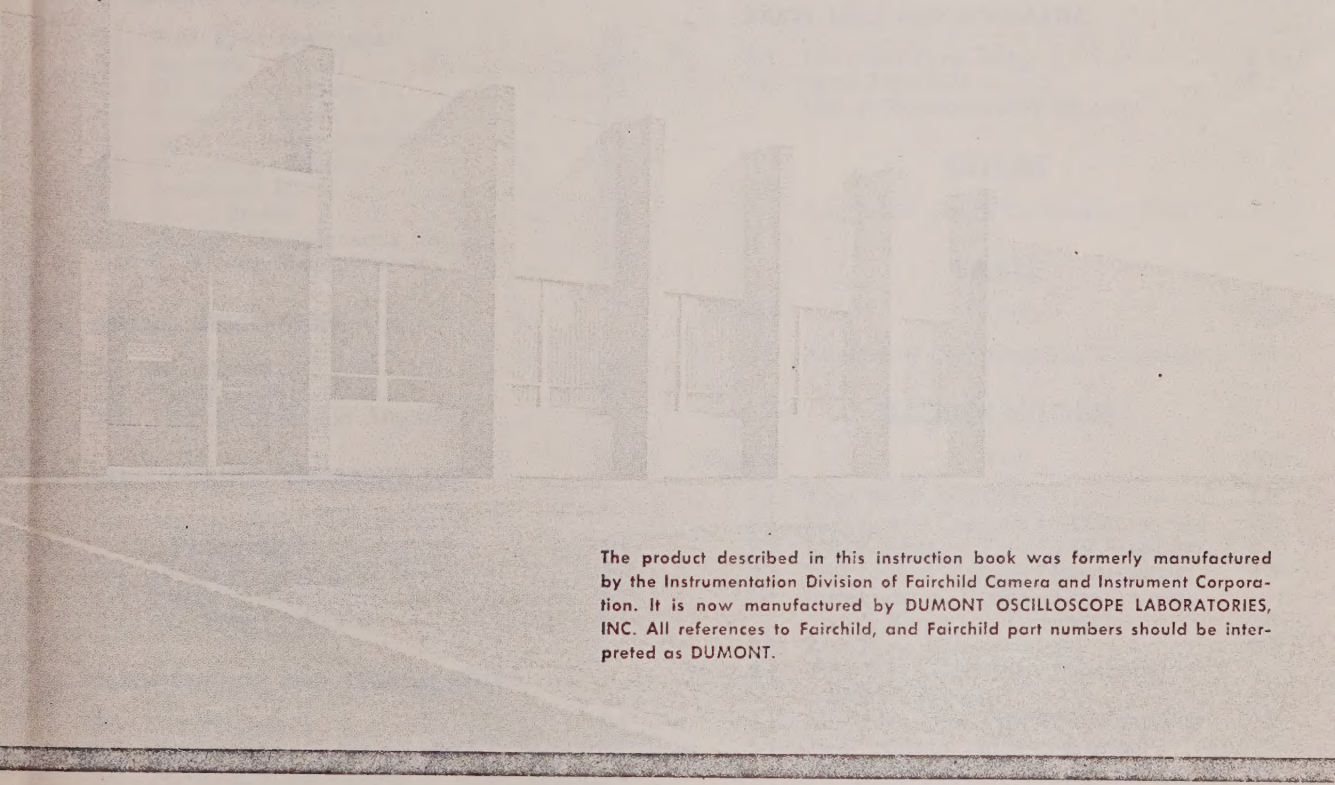

The product described in this instruction book was formerly manufactured by the Instrumentation Division of Fairchild Camera and Instrument Corporation. It is now manufactured by DUMONT OSCILLOSCOPE LABORATORIES, INC. All references to Fairchild, and Fairchild part numbers should be interpreted as DUMONT.

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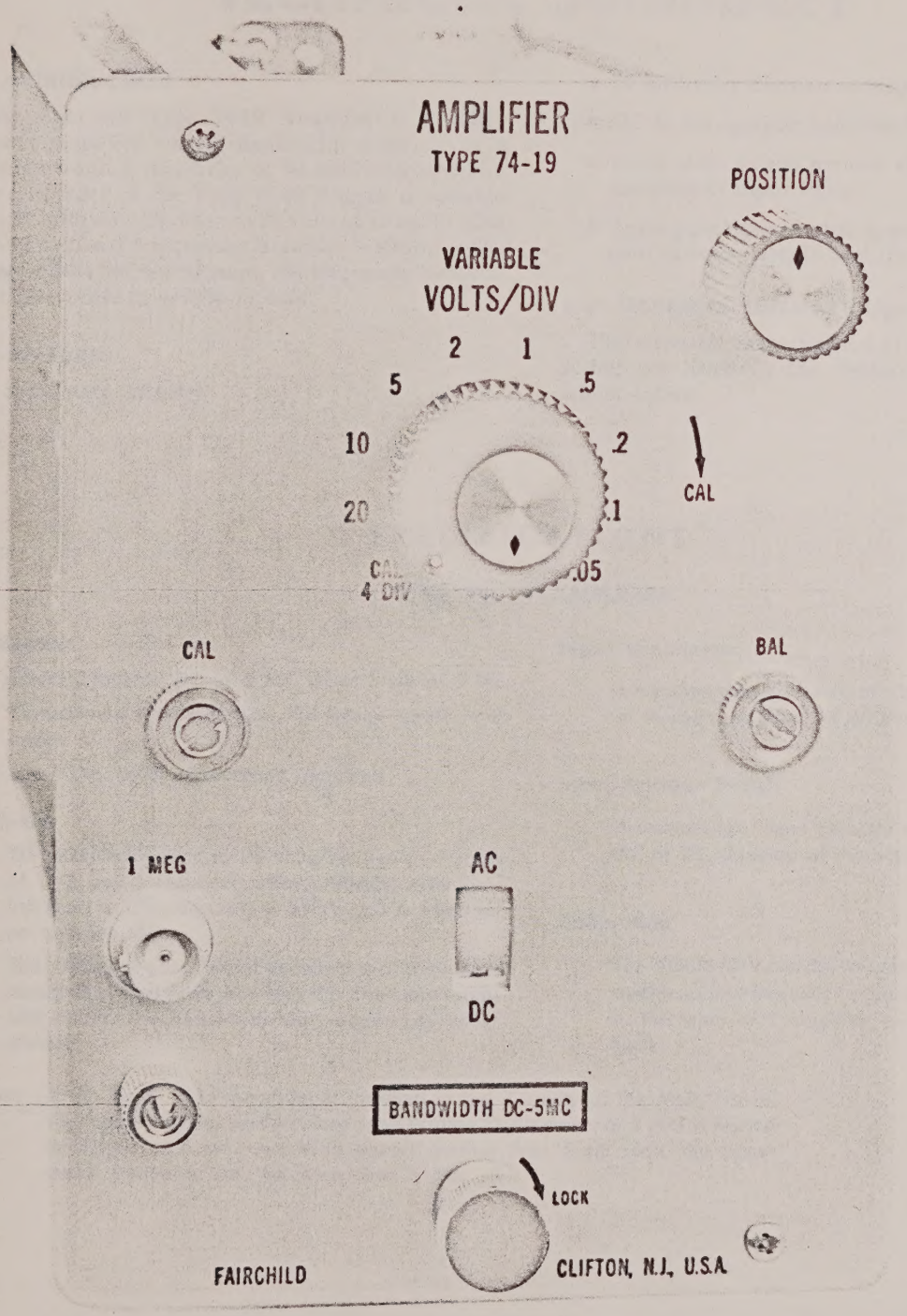


Figure 1-1. Type 74-19 Amplifier

SECTION 1

TECHNICAL SUMMARY

1-1. INTRODUCTION

The Fairchild Type 74-19 Amplifier is a single channel amplifier with a bandwidth from dc to 5 megacycles and a sensitivity of 50 millivolts/division. The sensitivity of the Type 74-19 Plug-in is variable from 50 millivolts/division to 20 volts/division in nine steps of 1, 2, and 5 sequence. Accuracy is within ±3% at each of the calibrated steps. All frequency measurements are made at 4-division scan.

1-2. FEATURES

- Solid state circuitry
- 50 millivolts/division sensitivity
- DC to 5-megacycle bandwidth
- Panel slide switch permits capacitance or direct coupling of input signal
- Front panel gain control is provided to normalize gain between plug-in and the Main Frame

1-3. TECHNICAL SUMMARY (Specifications)

The electrical characteristics of the Type 74-19 Amplifier are listed in the Performance Specifications which follow.

SPECIFICATIONS

TYPE 74-19 AMPLIFIER

Bandwidth*

Direct Coupled: DC to 5 Mc; down 3 db at 5 Mc

Capacitively Coupled: Low frequency cutoff is 2 cycles

Rise Time: 0.07 microsecond (nominal)

Sensitivity

50 millivolts/division to 20 volts/division in 9 steps of 1, 2, and 5 sequence when VARIABLE gain control is set to CAL; accurate to within ±3% when set on any one step

The VARIABLE gain control permits 3 to 1 continuous sensitivity adjustments between the attenuator steps and extends the 20 volts/division range to 60 volts/division

Input Impedance

1 megohm shunted by 40 pf. Coupling may be direct or through capacitor of 600-volt rating to amplifier

Input Selector Switch

A two-position Input Selector switch provides either AC or DC coupling of the input signal

Calibration

The VOLTS/DIV switch includes a CAL position which applies a line-frequency square wave signal directly to the input of Y amplifier to aid in standardizing gain

* Note: If the Type 74-19 Amplifier is installed in the X cavity of the Main Frame, the high-frequency performance specification (3 db down at 5 Mc) is limited to signals of 6 cm scan. With signals greater than 6 cm scan, the upper cutoff frequency may be lower than 5 Mc.

SECTION 2
OPERATING INSTRUCTIONS

2-1. FIRST TIME OPERATION (Figures 2-1 and 2-2)

Unless otherwise designated, it is presumed that the Type 74-19 Plug-in Amplifier is inserted in the Y cavity (left-hand side) and Type 74-03A Time Base Plug-in is inserted in the X cavity (right-hand side) of the Main Frame. If the Type 74-19 Plug-in unit is inserted in the X cavity of the Main Frame, it will provide horizontal deflection of the trace and the information must be translated accordingly. In the instructions which follow, capital letters within the text indicate front-panel controls, connectors, or settings.

The following illustrations are designed to aid the operator in becoming familiar with the oscilloscope.

Figure 2-1. Function of Controls and Connectors

Figure 2-2. Initial Setup of Type 74-19 Amplifier

2-2. APPLYING A SIGNAL

The signal to be displayed is applied to the Input connector on the front panel. To insure proper performance, the signal should be applied through a shielded cable, with the shield connected to the chassis of both the oscilloscope and the signal source.

Accessory Probes are available for use with the Type 74-19 Amplifier and are listed in the Type 766H Series Oscilloscope Instruction Manual.

2-3. DC BAL ADJUSTMENT

If the dc balance of the Type 74-19 Amplifier is not properly adjusted, the reference trace on the screen will be depositioned when the VARIABLE control is rotated. To properly adjust the DC BAL front-panel screwdriver control, proceed as follows:

1. Set VOLTS/DIV switch to 20 and rotate VARIABLE control to its minimum gain setting.
2. Adjust the appropriate Time Base for automatic sweep to obtain a reference trace on the screen.
3. Using the POSITION control on the Type 74-19 Amplifier, position the trace to screen center (reference line).
4. Turn the VARIABLE control to the calibrated position and note any deflection.
5. Adjust the DC BAL control until the trace is positioned to the reference line established in step 3. Do *not* change the POSITION control setting.
6. Continue to adjust the DC BAL control until there is no depositioning of the trace when the VARIABLE control is rotated back and forth throughout its range.

2-4. GAIN ADJUSTMENT

Whenever the Type 74-19 Amplifier is removed from the Main Frame and inserted in another, the front-panel screwdriver CAL control must be reset. This procedure is necessary to compensate for difference in deflection plate sensitivities. In addition, if the Type 74-19 Amplifier is switched from the Y cavity to the X cavity of the same Main Frame, readjustment will be necessary since CRT sensitivities are different between the X and Y plates; CAL control compensates for this. To properly normalize the gain between the Plug-in unit and the Main Frame, proceed as follows:

1. Set the VOLTS/DIV switch to CAL and turn the VARIABLE control to CAL.
2. Set the front-panel screwdriver CAL control for precisely 4 divisions of deflection.

2-5. INPUT COUPLING SELECTION

The AC/DC position of the Input Selector switch permits choice of retaining the dc level of the input signal or blocking the dc component of the input signal by inserting a capacitor in series with the input. If it is desired to display both the ac and dc components of a signal, set the Input Selector switch to DC. Thus, the position of the display at any instant is a function of the instantaneous signal voltage with respect to ground.

There are times when it is neither necessary nor desirable to display the dc component of the input waveform. A capacitor placed in series with the input connector will exclude the dc component while simultaneously permitting the ac component to be displayed. This is accomplished when the Input Selector switch is set to AC. The effect of the dc component is now excluded from the display.

It should be noted that when the Input Selector switch is set to the AC position, the lower frequency limit (3 db) of the amplifier is about 2 cycles. Therefore, some low-frequency distortion and loss of amplitude will occur if the pattern on display contains frequency components below the specified cutoff.

Use of a 10:1 Attenuator Probe brings low frequency ac response to 0.2 cycles.

2-6. OBTAINING A DISPLAY

To use the Type 74-19 Amplifier to obtain a display, proceed as follows:

1. Signals to be observed are connected to the Type 74-19 Amplifier through the Input BNC connector via shielded cable or an attenuator probe.
2. Establish a common ground between the oscilloscope chassis and the signal source.

VOLTS/DIV

Switch: calibrated attenuator variable from 50 mv/div to 20 volts/div in 9 steps. CAL position also provided

VARIABLE

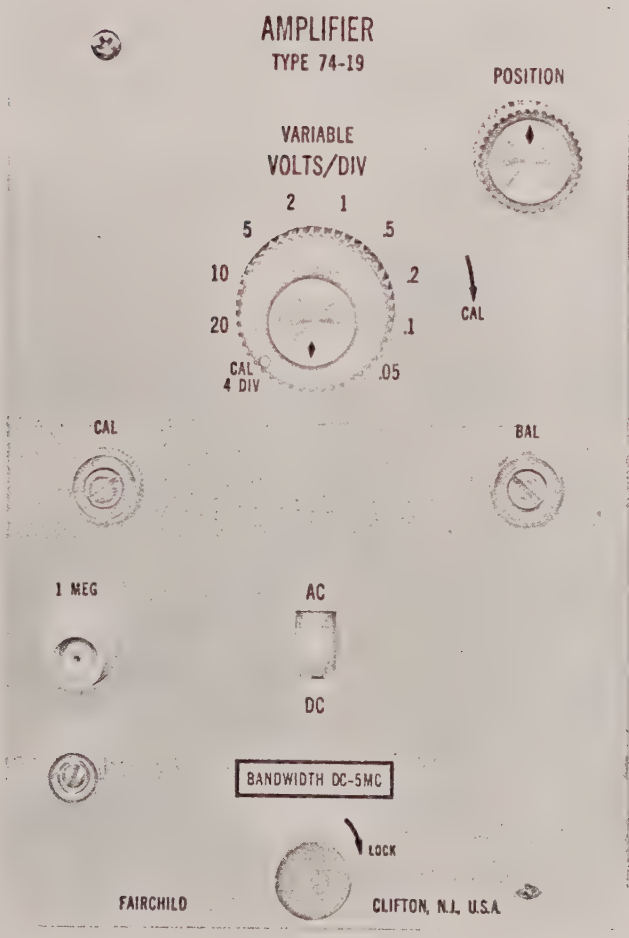
Control: provides a 3:1 continuous sensitivity adjustment between calibrated steps and extends the 20 volts/div range to 60 volts/div

CAL

Screwdriver control: used to set the gain of the amplifier for a specific deflection of 4 div when VOLTS/DIV switch and VARIABLE control are both preset to CAL

INPUT

BNC connector for applying external signals to the input amplifier.



POSITION

Control: used to position the trace vertically when the Type 74-19 Plug-in Amplifier is normally inserted in its Y cavity. If this plug-in is inserted in the X cavity, it will position the trace horizontally

BAL

Screwdriver control: when properly adjusted prevents depositioning of the pattern when VARIABLE gain control is varied

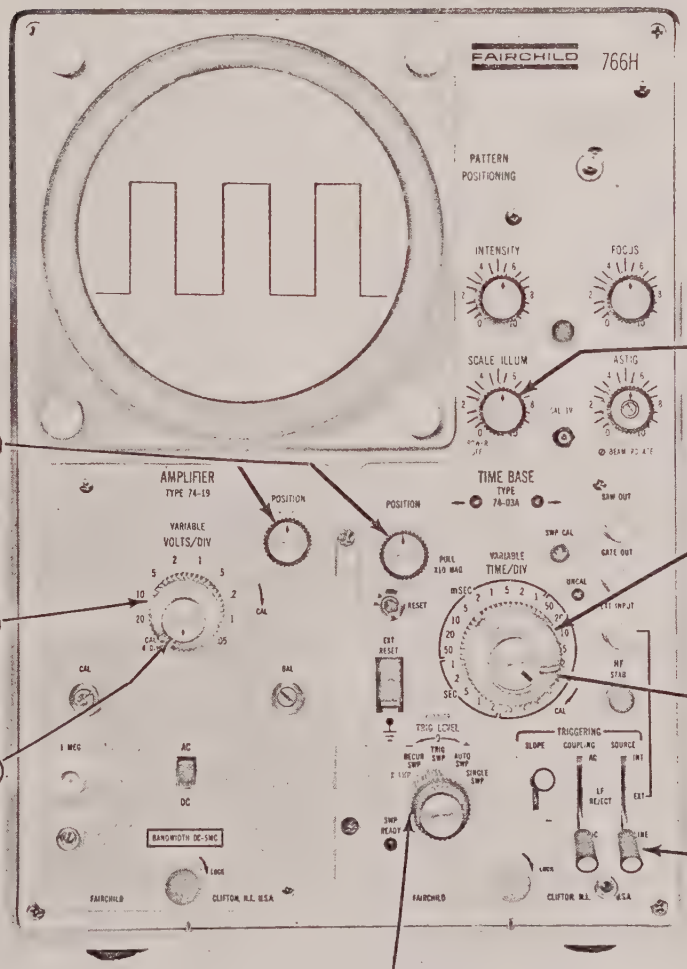
INPUT SELECTOR

Slide switch selects input signal with or without a dc blocking capacitor

Figure 2-1. Function of Controls and Connectors

To obtain the calibrator display, set the controls exactly as shown and perform the numbered steps in sequence.

Use the same procedure when difficulty is experienced when obtaining a display. This will eliminate "cockpit" troubles due to misalignment of controls.



Set ASTIG, FOCUS, & INTENSITY controls to center of range

Readjust INTENSITY, FOCUS & ASTIG controls for a sharp pattern. Readjust 6 to center the display

1. Rotate clockwise to turn on the oscillascope

Set POSITION controls to center of range (6)

2. Set outer knob (TIME/DIV) to 5 mSEC

Set outer knob (VOLTS/DIV) to CAL (7)

3. Rotate inner knob (VARIABLE) clockwise to CAL until switch is actuated (click is heard). Note that UNCAL lamp is off

Rotate inner knob (VARIABLE) fully cw (8)

4. Set TRIGGERING switches to +, DC, LINE

5. Set outer knob (Sweep Mode Selector) to AUTO SWP

NOTE

The front-panel screwdriver BAL control on the Y Plug-in must be properly adjusted to obtain an on-screen trace. See the text for further details

Figure 2-2. Initial Setup of Type 74-19 Amplifier

3. The Input Selector switch permits choice of capacitive or direct coupling of the signal to the compensated attenuator.

4. Adjust the appropriate Time Base Plug-in controls to obtain a stable display of the pattern.

5. Set the VOLTS/DIV switch and POSITION control such that the size and position of the display is as desired on the screen.

2-7. ADDITIONAL HINTS

In addition to the information given in the preceding paragraphs, observe the following precautions when applying signals to the oscilloscope:

1. Avoid errors in readings due to stray coupling between circuits, particularly in the signal lead. As a rule, do not use long, unshielded leads for applying signals to the oscilloscope. This fact holds for the audio-frequency spectrum, except possibly when making measurements on low impedance circuits at very low frequencies. Coaxial or shielded input cables are recommended for most applications.

2. In broad band applications, it may be necessary to terminate a coaxial cable with a resistance equal to its characteristic impedance. This is done to prevent standing waves or ringing (high-frequency damped oscillations).

3. To avoid erroneous results, the operator should simulate the actual operating conditions of the equipment being tested. For example, the equipment should work into a load impedance equal to that which it will see in actual use.

4. Consider the effect of loading upon the signal source due to the input impedance of the oscilloscope. The input impedance can be represented by a resistance shunted by a capacitance. The effective value of this impedance is indicated in the Specifications. However, the operator should be aware that even with a few feet of cable in the input circuit, the loading capacitance on the circuit under investigation might be greater than 100 pf.

5. There are cases when connecting the input of the oscilloscope to a signal source, the effect of loading the source is not negligible. To minimize this loading and therefore obtain a valid measurement, a probe may be used in the manner described in the paragraph entitled "Use of Probes".

6. Care must be exercised when applying a fast rise, high-frequency signal to the Input connector. It is necessary to match and properly terminate the coaxial cable applying the signal to the oscilloscope or ringing on the rising and falling portion of the waveform will result.

7. As the length of the cable is increased, the necessity for proper termination becomes very important. This termination is generally inserted at the oscilloscope end of the cable, although many signal sources may require an additional termination at the other end of the cable.

8. Passive attenuator probes will generally reduce bandwidth and slow the display system rise time. Consider the effect of probe loading and response in your measurements.

For rack-mounting systems, observe the following precautions if long shielded cables are used.

1. It may be desirable to ground long shielded leads only at one end to avoid circulation currents. Even microamperes of extraneous currents in the shielded braid will cause unwanted distortions.

2. Use cable with insulation over the shielded braid so that the cable shield does not accidentally touch ground.

3. Use off-ground insulated bulkhead feed-thru connectors where applicable.

4. Do not pass cables near strong ac magnetic fields.

5. Long shielded input cables may also induce parasitic oscillations. It is suggested that a 1000-ohm, ½-watt resistor be connected in series with the center conductor near or at the oscilloscope input terminals.

6. Use a resistance at least twice that required to just stop the parasitic oscillations. Too large a value may reduce the bandwidth of the system.

2-8. USE OF PROBES

An attenuator probe lessens both the capacitive and resistive loading caused by the oscilloscope to a minimum value. Simultaneously, while isolating the oscilloscope from the signal source, it reduces the effective sensitivity of the instrument. In other words, the displayed waveform will be reduced in amplitude by the attenuation factor of the probe. The attenuation introduced by the probe permits measurement of signal voltages in excess of those which may be accommodated by the instrument.

When using a probe to sample signals from a tuned, matched, or otherwise critical circuit, capacitive loading may cause erroneous readings. In these cases it may be necessary to remove capacity and resistance from the circuit under observation. When the observations and adjustments are completed, capacitance and resistance precisely equal to that of the probe impedance, should be added to the circuit after the probe is removed from the circuit. This substitution will equalize loading and restore the operating characteristics of the circuit under observation to the same conditions when probe measurements were made.

When using the attenuator probe to make amplitude measurements, multiply the observed amplitude of the display by the attenuation factor marked on the probe.

The Accessory Probes listed in Section 1 of the Type 766H Series Instruction Manual, have an attenuation factor of 10 to 1. The maximum voltage that may be applied to these probes is 600 volts dc plus peak ac. Voltages in excess of this value (either dc volts or peak ac volts) may cause damage to components inside of the probe housing.

IMPORTANT: Before using the probe, always check its adjustment.

An adjustable capacitor in the probe compensates for variations in input capacitances from one unit to another. To insure accuracy in pulse and transient measurements, check the probe adjustment frequently. To check the probe, proceed as follows:

1. Connect the probe to Input BNC connector on the Type 74-19 and apply the probe tip to the 1V CAL pin jack on the Main Frame. Set Input Selector switch to DC.
2. Adjust the oscilloscope to display several cycles of the calibrator waveform.
3. Adjust the variable capacitor in the body of the probe for a flat-top trace on the screen.
4. To preserve the waveform of the signal being displayed, clip the probe ground lead to the chassis of the equipment being tested. Select a short, clean ground point near the probe input connection.

2-9. VOLTAGE MEASUREMENTS

NOTE

When making voltage measurements, make sure there is a common ground between the oscilloscope and the signal source.

a. General

The Type 766H Family of Oscilloscopes may be used to measure the voltage of the input signal by using the calibrated VOLTS/DIV setting and observing the height of the display on the screen in graticule divisions.

When making voltage measurements, the operator should try to set up the instrument for full scale vertical deflection to insure maximum accuracy. Also, it is important to remember that the width of the trace may be an appreciable part of the over-all measurement. This is particularly true when you are measuring signals of small amplitude or when stray signal pickup has broadened the trace. The operator should consistently make all measurements from one side of the trace. If the top side of the trace is used for one reading, it should be used for all succeeding readings.

b. How to Measure Peak-to-Peak Voltages Using the CRT Scale

The procedure employed for all voltage measurements is basically the same. The VARIABLE control must be set to CAL. The specific examples that follow are intended to show the general procedure. These examples may be adapted to fit any particular application.

To measure the ac component of the signal on display, set the Input Selector switch to AC. In this position, only the ac components of the input signal are displayed on the screen. However, when the ac components of the input is of very low frequency (below 2 cps), set the Input Selector switch to DC to prevent errors.

To make measurements, proceed as follows:

1. Using the calibrated scale, measure the vertical deflection in graticule divisions from the positive peak to the negative peak of the waveform. See Figure 2-3.
2. Multiply the vertical dimension obtained in step 1 by the VOLTS/DIV switch setting to obtain the indicated voltage.
3. Multiply the indicated voltage obtained in step 2 by the attenuation factor of the probe, if one is used, to obtain the actual peak-to-peak voltage.

For example, suppose that you are using a 10:1 Attenuator Probe and the VOLTS/DIV switch is set to 0.1. Assume that the vertical distance between the peaks of the waveform measures 4 graticule divisions. Now, this graticule dimension of 4 is multiplied by the VOLTS/DIV setting of 0.1 to give 0.4 volt. Next, multiply this result by 10, the attenuation factor of the probe. This gives 4 volts as the peak-to-peak voltage of the display waveform.

Note: Always make sure that the VARIABLE control is set to CAL when making measurements.

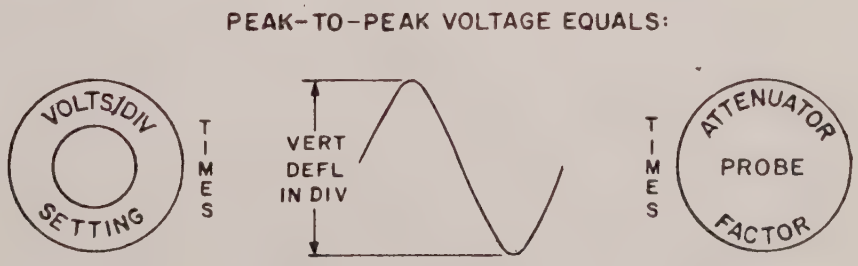


Figure 2-3. Peak-to-Peak Voltage Measurements

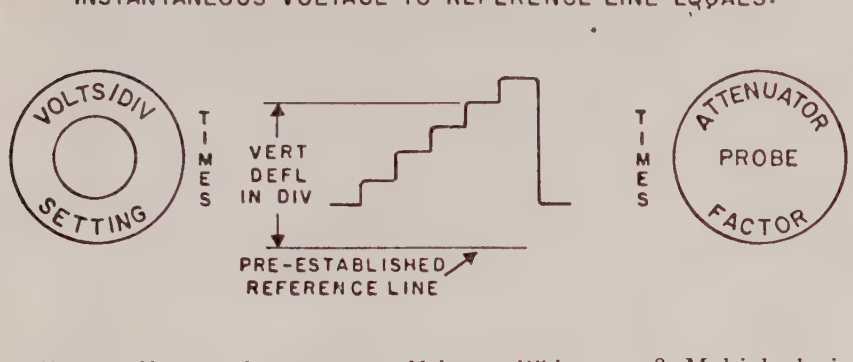


Figure 2-4. Instantaneous Voltage Measurement With Respect to Ground (or some other Reference Potential)

c. How to Measure Instantaneous Voltages With Respect to Ground (or Some Other Reference Potential) Using the CRT Scale

The technique used for measuring instantaneous voltages with respect to a reference point is virtually the same as that described for peak-to-peak voltage measurements. The difference is that now a reference point must be established on the screen of the oscilloscope. Since voltage measurements with respect to ground are the most common, the procedure which follows establishes ground as the reference point. The same general technique may be used for instantaneous measurements with respect to any other potential, just so long as that potential is employed to establish the reference point.

To make measurements, proceed as follows:

1. Set the Input Selector switch to DC.
2. Adjust the appropriate Time Base Plug-in controls for automatic or recurrent sweep to obtain a reference trace.
3. To establish the reference point, touch the probe tip to the ground terminal on the oscilloscope (or to the desired source potential if a point other than ground is used). Vertically position the trace to a convenient point on the screen. This point should be chosen so that it lies on one of the major horizontal scale divisions. The chosen horizontal scale line, which is now coincident with the trace, is the reference line from which all voltage measurements are to be made.
4. Disconnect the probe tip from ground and connect it to the signal source without disturbing the POSITION control.
5. Adjust the oscilloscope controls for a suitable and stable display.
6. Using the calibrated scale, measure the number of graticule divisions from the desired point on the waveform to the pre-established reference line set up in step 3. See Figure 2-4.
7. Multiply the graticule dimension obtained in step 6 by the VOLTS/DIV switch setting to obtain the indicated voltage. Make sure that the VARIABLE control is set to CAL.
8. Multiply the indicated voltage obtained in step 7 by the attenuation factor of the probe used to obtain the actual instantaneous voltage.

For example, suppose that you are using a 10:1 Attenuator Probe and the VOLTS/DIV switch is set to 0.1. Assume that the vertical distance between the desired point on the waveform to the pre-established reference line is 4 graticule divisions. Now, multiply this vertical deflection of 4 divisions by the VOLTS/DIV setting of 0.1 to give 0.4 volt. Next, multiply this result by 10, the attenuation factor of the probe. This shows that the instantaneous voltage with respect to ground to be 4 volts. Since the voltage point is above the reference line, the indicated polarity is positive.

2-10. RISE-TIME MEASUREMENTS

Application of signals from a fast rise pulse generator will facilitate pulse rise-time measurements. When making such measurements, the one factor which must be borne in mind for most accurate quantitative results is the pulse response characteristic of the vertical amplifier. This characteristic is related to the observed pulse rise time and the actual pulse rise time in the following manner:

$$t_p = \sqrt{(t_o)^2 - (t_a)^2}$$

Where: t_p = actual pulse rise time in microseconds

t_o = observed rise time of pulse displayed on oscilloscope in microseconds

t_a = amplifier rise time in microseconds

Once the amplifier rise time is known (see Specifications), the rise time of any pulse may be calculated.

To make rise-time measurements, proceed as follows:

1. Adjust pattern for 4 divisions of vertical deflection.
2. Using the X and Y POSITION controls, adjust the display vertically so that the start of the waveform rests 2 minor divisions below the scale horizontal center line and the rising portion of the waveform inter-

sects the zero point on the scale (labeled A in Figure 2-5). Observe that the top of the waveform is off scale. Be careful not to accidentally change the setting of the X POSITION control.

3. With the Y POSITION control, move the waveform down until the top portion of the waveform rests 2 minor divisions above the horizontal center line.

4. Note where the rising portion of the waveform intersects the X axis (labeled B in Figure 2-5).

5. Measure the distance between points A and B; multiply this reading by the TIME/DIV switch setting to obtain rise time.

6. For example, if the distance between points A and B is 3 centimeters and the TIME/DIV switch is set to 5 μs, the rise time would be 15 μs.

7. Rise-time measurements made in this manner eliminate errors which would result from improper deflection plate alignment and incorrect interpolation.

8. Rise time of the amplifier may be checked by applying a pulse with an input rise time of 5 or more times faster than the amplifier.

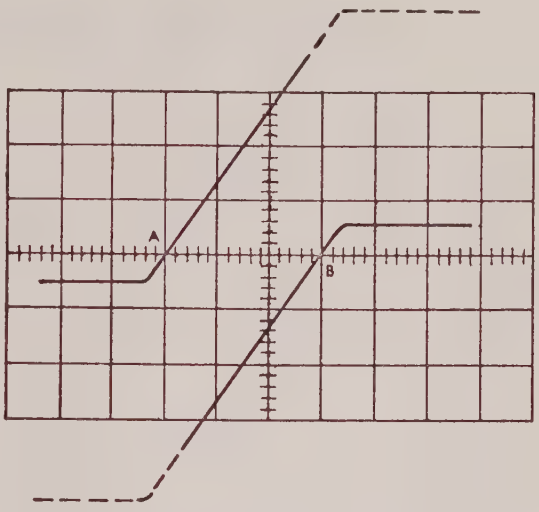


Figure 2-5. Rise-Time Measurements

SECTION 3
CIRCUIT DESCRIPTION

3-1. INTRODUCTION (Figure 3-1)

In the discussion to follow, emphasis is placed on the interrelation of circuits rather than on detail of operation. It is also recommended that the schematic at the rear of the manual be referred to in following the circuit description.

3-2. INPUT CIRCUIT

A BNC input connects the signal to the grid of amplifier V900A through the Input Selector and VOLTS/DIV switches.

The Input Selector switch permits choice of retaining the dc level of the input signal or blocking the dc component of the input signal by inserting a capacitor in series with the input. The VOLTS/DIV switch permits the desired attenuation of the input signal in calibrated steps as indicated by the front-panel markings.

An internal calibrating voltage is applied to the vertical input dc amplifier when the VOLTS/DIV switch is set to CAL. This automatically disconnects the Y Input signal from the amplifier when the calibrator signal is applied. The CAL front-panel screwdriver control is employed to normalize the gain between the Plug-in module and the Main Frame. When gains are normalized, the peak-to-peak value of the calibrator waveform will indicate 4 divisions of vertical deflection on the screen.

3-3. VERTICAL DEFLECTION AMPLIFIER

The input amplifier V900A and V900B, converts the single-ended input signal at the grid of V900A to a push-pull output signal at the plates of V900A and V900B.

Resistor R9021 in series with the grid of V900A, serves to suppress any parasitic high-frequency oscillations. Resistor R9018 is provided to limit grid current in the event that any excess voltage is applied to the input.

The VARIABLE control is connected between emitters of Q9001 and Q9002 in the gain control stage. Any difference in the dc level between the two emitters will cause the trace to shift vertically as the VARIABLE control is rotated. The dc BAL control nulls the dc voltage across the VARIABLE control so that in the absence of an input signal, there will be no depositioning of the trace when the VARIABLE control is rotated throughout its range.

A portion of the signal from the collector of Q9006 is applied to an RC compensated voltage divider. This latter circuit provides a signal for internal triggering of the associated Time Base plug-in.

The push-pull output signal from the input amplifier progresses through the amplifier stages as indicated on the functional block diagram Figure 3-1.

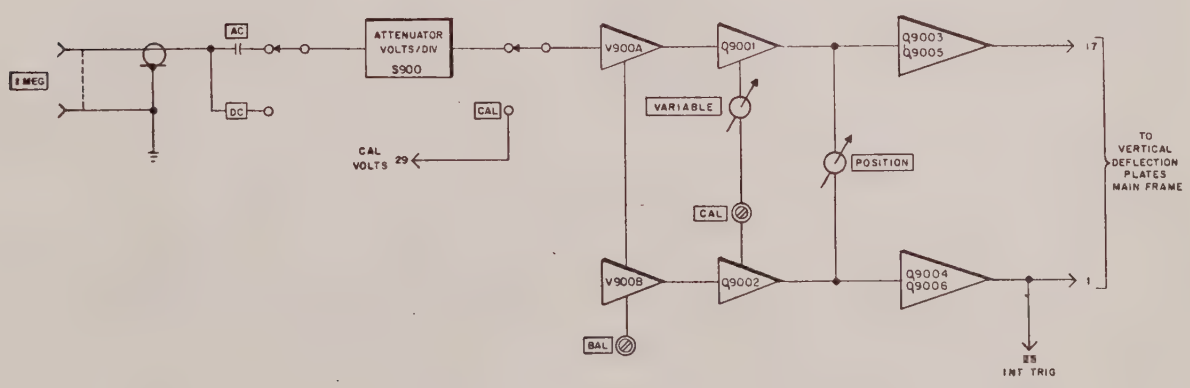


Figure 3-1. Type 74-19 Amplifier, Functional Block Diagram

SECTION 4
PERFORMANCE ASSURANCE TEST

4-1. MAINTENANCE CHECK TO ASSURE PERFORMANCE

The tests described in the paragraphs to follow should be performed by Instrument Test Departments and Maintenance Laboratories to certify proper performance. These tests are divided into sections for simplification and to assist those test groups where complete checking is not mandatory, or where all test equipment is not available. Refer to Section 5, paragraph 5-5, for list of test equipment required.

All tests are performed with a representative Type 766H Series Main Frame Oscilloscope and a Time Base Plug-in. Both of the plug-in units must be normalized to the Main Frame before starting tests. This is accomplished by adjusting the front-panel screwdriver SWP CAL and GAIN CAL controls as described in the appropriate plug-in Instruction Manuals. Allow 30 to 60 minutes of warmup time before making any adjustments.

NOTE

If this Plug-in Module is checked by a Receiving Inspection laboratory, the tests outlined below are recommended to certify performance. This instrument has been thoroughly tested and aged at the factory. Nevertheless, rough shipment, extreme environments, or long idle periods may necessitate minor adjustments of the controls. Hence, it is suggested that the certifying engineer try the recommended adjustments not only for recentering the controls, but also to ascertain their range and to familiarize himself with this precision instrument. If, after performing all the tests outlined in the paragraphs to follow, the instrument will not perform to specification, the assistance of the local Fairchild Engineering representative should be requested.

4-2. INITIAL SETUP OF TYPE 74-19 (Figure 4-1)

If the controls are set exactly as shown and performed in the sequence indicated in Figure 4-1, three cycles of the calibrator signal will be displayed on the screen. The procedure just given is a good, over-all check of this plug-in module.

4-3. CHECKING SENSITIVITY

1. Set VOLTS/DIV switch to CAL and rotate VARIABLE control fully clockwise to CAL.
2. Adjust Time Base unit for a sweep rate of 10 milliseconds/division and observe 6 cycles of the calibrator waveform at 60-cycle line. (5 cycles for 50-cycle line.)
3. Adjust dc BAL control after unit has been operating 60 minutes or more.
4. Check range of CAL front-panel screwdriver control; it should control the amplitude of the calibrator signal such that at least 4 divisions of deflection may be obtained when the unit is inserted in either X or Y cavity.
5. Set CAL control for precisely 4 divisions of deflection.

4-4. CHECKING Y ATTENUATOR

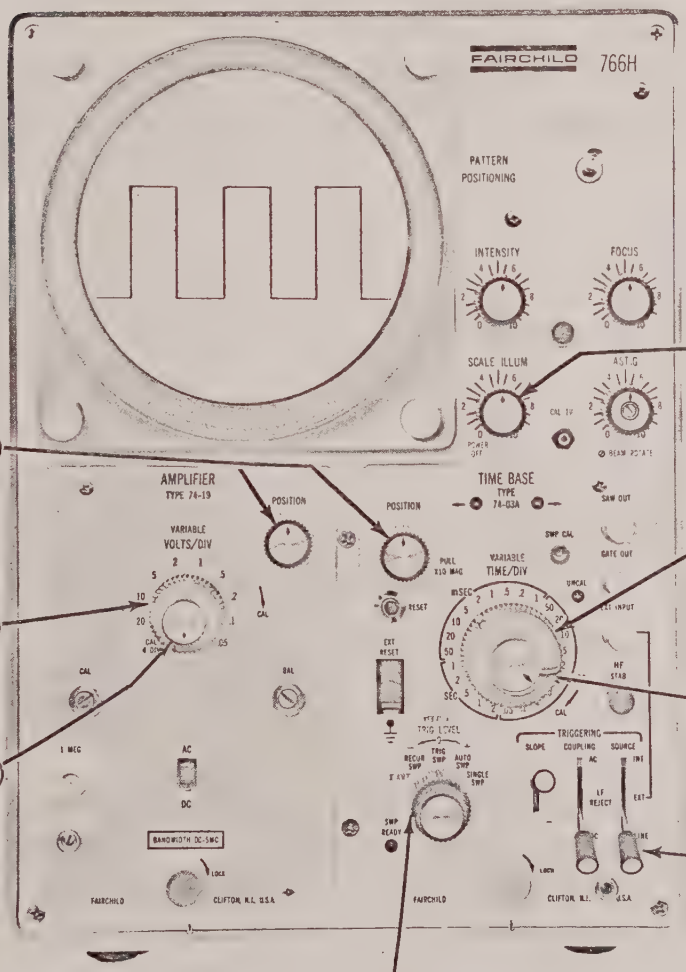
1. Connect the output of a Ballantine Type 420 Calibrator, or equivalent, to the input connector on the Type 74-19 Amplifier.
2. Refer to the accompanying Amplitude Check Calibration Chart for additional data.

AMPLITUDE CHECK CALIBRATION CHART

Volts/Div Setting	Generator Output Voltage	Divisions of Deflection ±3%
20	10V	0.5
10	10V	1
5	10V	2
2	10V	5
1	5V	5
0.5	2.5V	5
0.2	1V	5
0.1	500 mv	5
0.05	250 mv	5

To obtain the calibrator display, set the controls exactly as shown and perform the numbered steps in sequence.

Use the same procedure when difficulty is experienced when obtaining a display. This will eliminate "cockpit" troubles due to misalignment of controls.



Set ASTIG, FOCUS, & INTENSITY controls to center of range

Readjust INTENSITY, FOCUS & ASTIG controls for a sharp pattern. Readjust 6 to center the display

1 Rotate clockwise to turn on the oscilloscope

Set POSITION controls to center of range 6

2 Set outer knob (TIME DIV) to 5 mSEC

Set outer knob (VOLTS/DIV) to CAL 7

3 Rotate inner knob (VARIABLE) clockwise to CAL until switch is actuated (click is heard). Note that UNCAL lamp is off

Rotate inner knob (VARIABLE) fully cw 8

4 Set TRIGGERING switches to +, DC, LINE

5 Set outer knob (Sweep Mode Selector) to AUTO SWP

NOTE

The front-panel screwdriver BAL control on the Y Plug-in must be properly adjusted to obtain an on-screen trace. See the text for further details

Figure 4-1. Initial Setup of Type 74-19 Amplifier

SECTION 5
MAINTENANCE AND RECALIBRATION

5-1. INTRODUCTION

This section of the Instruction Manual contains service information and procedures for internal adjustments.

5-2. REMOVAL AND REPLACEMENT OF PARTS

If it is necessary to order a replacement component from the factory, always give the Type Number and Serial Number of the instrument. Before ordering parts for in-warranty replacement or purchasing them for out-of-warranty replacement, be sure to consult the Parts List in this manual. The Parts List gives the values, tolerances, ratings, and the factory part number for all electrical components used in the instrument. This will help to expedite service.

Since your instrument left the factory, some of the parts may have been superseded by improved components. In such cases, the part numbers of these new components will not be listed in your Parts List. However, if you order a part from the factory, and it has been superseded by an improved component, the new part will be shipped in place of the part ordered.

It is the aim of the Fairchild organization to make available the most reliable commercial oscilloscopes within the state of the art and to provide services which will help the user to rapidly restore any of our equipment to its specified performance. Your local Field representative maintains a limited number of spare parts. Also, the factory may be asked to airship replacement parts on a rush basis.

5-3. SERVICING HINTS

General maintenance and trouble shooting information is given in the Type 766H Series Oscilloscope Instruction Manual. In the following discussion, it is assumed that you have already read that information and have definitely isolated a trouble in this Plug-in Module.

In trouble shooting a plug-in unit, it becomes necessary to determine if the defect is in the plug-in or in the Main Frame of the oscilloscope. The quickest and easiest way of isolating the trouble is to substitute another plug-in unit and determine if the same trouble persists. If the trouble continues after substitution, it can be safely assumed that the defect is in the Main Frame.

There is no simple way of locating troubles. An understanding of the functions of the circuits is the best help. With an understanding of the circuit operation, it will be possible to make a good guess at the general source of troubles from the symptoms. As an aid in trouble shooting this unit, refer to the functional block diagram in Section 3 and also to the schematic.

To keep electronic units operating at top performance, it is desirable to check the equipment at regular intervals. The period between checks will depend on the installation and the conditions of operation. For these regular checks, clean all dust and dirt from the unit using a light air blast or soft brush. However, to insure the reliability of measurements, we suggest that you recalibrate the Plug-in after each 500 hours of operation or every six months if used intermittently. Also, the calibration of a unit should always be fully checked and adjusted after the repair or replacement of any component in the unit. The complete adjustment procedure for this unit is given in this Section of the Instruction Manual.

In the event of improper performance of the Plug-in unit, the following suggestions are recommended:

1. The Type 4294 Extension Cable for remote operation of the plug-in from the oscilloscope is available as an accessory. This plug-in extender will be helpful for routine maintenance and recalibration. Do not use this extension for HF alignments; instead, remove the Main Frame side cover.

2. A Type 766H Test Oscilloscope is recommended for localizing troubles, especially when servicing a Type 74-19 inserted in a Type 767 Oscilloscope. To check waveforms, use a high-impedance probe while trouble shooting.

3. Maintain a high quality of workmanship. Use a clean bench and soldering iron; keep solder joints smooth and bright; do not overheat any component while soldering. Use heat sinks when soldering semiconductors. The use of a 30-watt iron such as a Hexacon Type 26S is recommended.

4. When using accessory probes or adapters, be sure the trouble is not originating in the accessory before suspecting the instrument itself.

5. Once the defective stage has been localized, the component or components causing the trouble can be located by tube and component substitution or by voltage measurement. Key voltage measurements are shown on the over-all schematic at the rear of this manual.

6. Electron tubes, semiconductors, and service adjustments are identified on photographs located in this Section of the manual.

5-4. GAINING ACCESS TO CHASSIS

Since the Plug-in is not contained in its own dust cover, most of the components are readily accessible when the plug-in is removed from the Main Frame. To gain access to the chassis, simply unscrew the knurled thumbscrew at center bottom of unit and pull it free of the Main Frame.

WARNING

WHEN THE COVERS OR PLUG-INS ARE REMOVED FROM THE INSTRUMENT FOR SERVICING, EXERCISE CAUTION WHILE THE POWER IS ON. The lower-voltage busses are potentially more dangerous than the cathode-ray tube potential because of the high current capabilities and large filter capacitors employed in these supplies. When you reach into the instrument with one hand while it is turned on, do not grasp the metal frame with the other hand. If possible, stand on an insulated floor and use insulated tools. It is advisable to ground the third lead in the power cord whenever the instrument is in use.

Note: Always use insulated tools while working or making adjustments on the unit when power is on. The transistors in this instrument may be damaged if over-voltaged by accidental grounding of one or more elements. Exercise caution and turn off power when making repairs.

5-5. TEST EQUIPMENT REQUIRED FOR SERVICING ADJUSTMENTS

a. Introduction

The adjustments outlined in the following paragraphs are based on the test procedure followed at the factory. All adjustments should be made at mid-line voltage, 115V/230V ±2%.

To set up the Amplifier Plug-in unit for calibration, insert the Amplifier Plug-in and the Time Base Plug-in into the Main Frame. The Time Base Plug-in module and Main Frame must be fully tested and certified units.

b. Test Equipment Required (Equivalent may be substituted)

Equipment	Description
Oscilloscope	Fully certified and tested Type 766H Main Frame
X Plug-in	Type 74-03A
Volt-ohmmeter	Simpson Model 260; 20K ohms/volt sensitivity
Square Wave Generator	Fairchild Type 791
Sine Wave Generator	Boonton Type 82 Constant Amplitude Sine Wave Generator
Standard Amplitude Calibrator	Ballantine Type 420
Capacitance Standardizer	Fairchild Type 7012A (1M, 40 pf)
Extension Cable for Remote Operation of Plug-in	Fairchild Type 4294
Alignment Tools	Fairchild Type 7013 Tool Kit

Turn on the power and allow 30 minutes of warm-up time.

5-6. DC BAL ADJUSTMENT (R9014)

If the dc BAL control of the Type 74-19 Amplifier is not properly adjusted, the reference trace on the screen will be depositioned when the VARIABLE control is used. To properly adjust the dc BAL front-panel screwdriver control, proceed as follows:

1. Set VOLTS/DIV switch to 20 and rotate VARIABLE control fully counterclockwise.
2. Adjust the oscilloscope to obtain a reference trace on the screen.
3. Using the POSITION control on the Type 74-19 Amplifier, position the trace to screen center (reference line).
4. Turn the VARIABLE control fully clockwise (detented position) and note any deflection.
5. Adjust the dc BAL control until the trace is positioned to the reference line established in step 3. Do not change the POSITION control setting.
6. Continue to adjust the dc BAL control until there is no depositioning of the trace when the VARIABLE control is rotated back and forth throughout its range.

5-7. NORMALIZING AMPLIFIER SENSITIVITY AND CERTIFYING THE CALIBRATOR

The CAL front-panel screwdriver control (R9031) is employed to calibrate amplifier sensitivity.

To properly normalize the gain of this instrument, proceed as follows:

1. Preset front-panel controls as indicated.

Control	Setting
VOLTS/DIV	0.05
VARIABLE	Fully cw (CAL)
Input Selector	DC

2. Apply a 200-millivolt input signal from the Ballantine Type 420 Calibrator to the input connector.
3. Adjust CAL control for precisely 4 divisions of vertical deflection. The vertical system is now normalized to the external standard.
4. Set the VOLTS/DIV switch to CAL. The internal calibrator signal should be displayed on the screen with an amplitude of 3.9 to 4.1 divisions. If these limits are not met, certify the Ballantine Calibrator to an external standard.

5-8. DEFLECTION PLATE LEVEL ADJ (R9057)

1. With no signal input, adjust the oscilloscope to obtain a trace centered on the screen.
2. Temporarily short together the vertical deflection plate leads.

3. Connect a voltmeter from the now common collectors to ground.

4. Adjust the DP LEVEL ADJ potentiometer R9057 for 90 volts.

5. Disconnect the meter and the Y deflection plate short.

5-9. INPUT CAPACITANCE STANDARDIZATION ATTENUATOR ALIGNMENT (Figures 5-1 and 5-2)

The input capacitance standardization and attenuator alignments are interdependent, therefore both tests must be performed in the same procedure. These adjustments are factory aligned and should not be touched unless there is positive indication that they require adjustment. The need for readjustment is normally indicated by distortion of fast-rising waveforms on one or more of the most sensitive ranges of this plug-in.

Standardization of the input capacitance of this plug-in requires the use of a 40-picofarad Capacitance Standardizer. To properly adjust the input capacitance and the attenuators of this plug-in unit, proceed as follows:

1. Adjust the trimmer of the Type 7012A Capacitance Standardizer to give 40 pf with a capacitance meter. If this meter is not available, set the input trimmers C9001 and C9004 to mid-range and adjust the trimmer in the Type 7012A instead of C9001 and C9004.

2. Connect the Type 7012A directly to INPUT A BNC connector on the Type 74-19 Amplifier.

3. Set the VOLTS/DIV switch to 0.1 and the Input Selector switch to DC.

4. Apply the output from a Fairchild Type 791 Square Wave Generator, or equivalent, through an RG-8A/U 50-ohm cable terminated in 50 ohms, through the 40-picofarad Capacitance Standardizer which is connected to the Type 74-19 Amplifier. See Figure 5-1.

5. Set the Square Wave Generator to 5 Kc and adjust the Time Base controls for a display of several cycles.

Note: Always center the square wave display on the cathode-ray tube screen. (Screen and square wave centers should agree within ±1 division or less.)

6. Adjust input trimmer C9001 for optimum square wave. Note comment in step 1 of this paragraph. See Figure 5-2.

7. Set VOLTS/DIV switch to 0.2 and adjust input trimmer C9001 for optimum square wave response.

8. Disconnect the 40 pf Capacitance Standardizer from the setup and reconnect the generator to the input connector.

9. Set Square Wave Generator to obtain 4 divisions of deflection and adjust trimmers indicated in Table 5-1 for flat-topped response.

TABLE 5-1

ATTENUATOR COMPENSATION TRIMMERS

VOLTS/DIV Setting	Adjust Trimmers for Flat Top
0.1	C9003
0.2	C9007
0.5	C9009
*1	C9008
*2	Readjust C9008
5	C9014
*10	C9012
*20	Readjust C9012

* It may be necessary to switch back and forth between these adjacent ranges to achieve optimum square wave response.

5-10. HIGH FREQUENCY ADJUSTMENT (C9023, C9024 and C9026)

1. Preset front-panel controls as indicated.

Control	Setting
VOLTS/DIV	0.05 5-7
VARIABLE	Fully cw (CAL)
Input Selector	AC

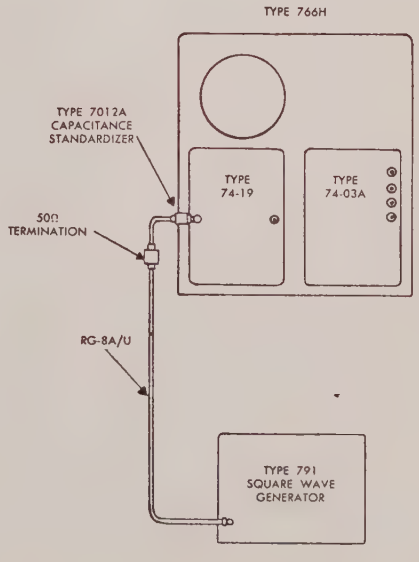
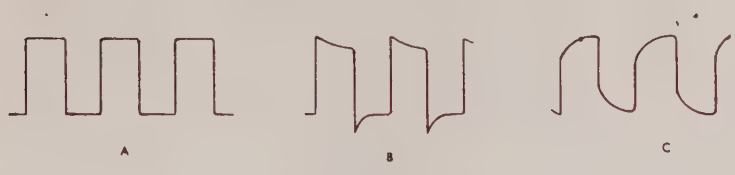


Figure 5-1. Test Setup for Adjusting Input Capacitance



A: Proper Adjustment
B, C: Improper Adjustment

Figure 5-2. Standardizing the Input Capacitance

2. Apply the output from a Fairchild Type 791 Square Wave Generator set to 100 Kc through a 50-ohm cable, then through a General Radio 10 or 20-db pad as required to the Input connector terminated in 50 ohms.

3. Adjust output of generator to give 4 divisions of vertical deflection.

4. Adjust oscilloscope for several cycles of the display.

5. Adjust trimmers C9023, C9024, and C9026 for best flat-top square wave response.

Note: When the Type 74-19 is used in the X cavity, trimmer capacitor C9026 must be readjusted. It must also be readjusted when the Plug-in is reinstalled in the Y cavity.

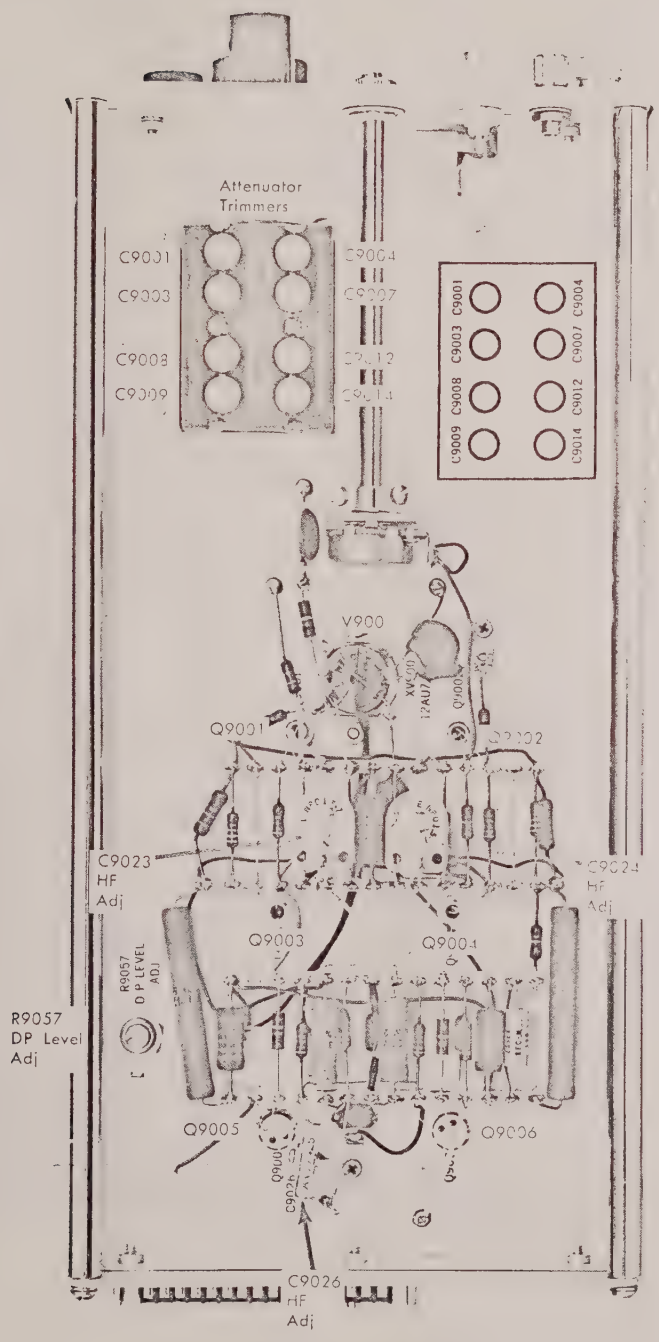


Figure 5-3. Left Side View Showing Service Adjustments and Transistors

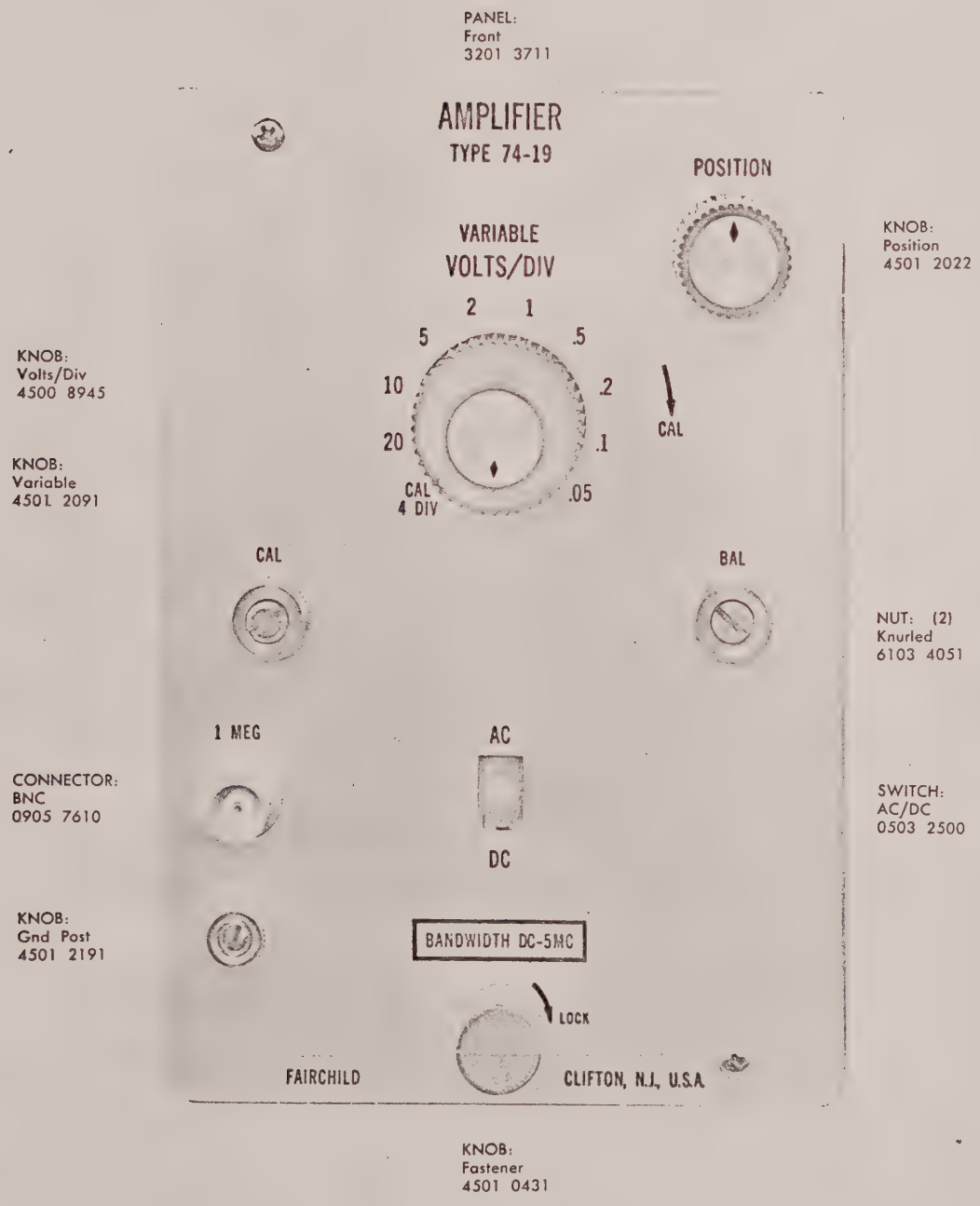


Figure 6-1. Front Panel Replaceable Parts

SECTION 6
ELECTRICAL PARTS LIST AND SCHEMATIC

TYPE 74-19 AMPLIFIER PLUG-IN

CAPACITORS

Notes: 1. All capacitors are variable, ceramic, and 500V unless otherwise specified; pf ($\mu\mu$f) denotes picofarads.
2. GMV denotes Guaranteed Minimum Value.

Symbol	Part Number	Description	Recommended Vendor Code	Type
C9001	0327 3600	2-8 pf, 300V	ERC	538-011
C9002	0315 6990	fixed, 10 pf, ±1%, 1000V	RMC	C
C9003 & C9004	0327 3610	5.5-18 pf, 300V	ERC	538-011
C9007 & C9008	0327 3610	5.5-18 pf, 300V	ERC	538-011
C9009	0327 3600	2-8 pf, 300V	ERC	538-011
C9011	0316 0530	fixed, 30 pf, ±5%	ERC	801
C9012	0327 3610	5.5-18 pf, 300V	ERC	538-011
C9014	0327 3600	2-8 pf, 300V	ERC	538-011
C9016	0326 8700	fixed, mica, 250 pf, ±10%	ERV	652-003
C9017	0327 3830	fixed, plastic, 0.1 μf, ±10%, 600V	FAST	F308
C9018	0317 3840	fixed, 330 pf, ±10%	EIA	
C9019	0326 4640	fixed, 0.01 μf, GMV	ERC	811
C9021	0326 4640	fixed, 0.01 μf, GMV	ERC	811
C9022	0326 7860	fixed, plastic, 0.1 μf, ±10%, 200V	AMX	C296AB
C9023 & C9024	0326 9340	1.5-7 pf	ERC	503-000
C9026	0327 2990	mica, 24-200 pf, 350V	EMC	425
C9027	0305 5250	fixed, mica; 220 pf, ±5%	EIA	
C9028	0317 5190	fixed, mica, 47 pf, ±5%	EMC	DM15
C9029	0317 5100	fixed, mica, 20 pf, ±5%	EMC	DM15

ELECTRICAL CONNECTORS

Symbol	Part Number	Description	Recommended Vendor Code	Type
J9001	0905 7610	receptacle, BNC, rf, female, 1 contact (1 MEG)	DAG	
J9002	6091 1692	stud, threaded	ABD	
P9001	0905 7340	plug, general purpose, male, 32 contacts	APH	26-159-32

COIL

Symbol	Part Number	Description	Recommended Vendor Code	Type
L9001	2102 0370	rf, 120 uh, ±5%	ESX	RFC M 120

TRANSISTORS

Symbol	Part Number	Description	Recommended Vendor Code	Type
Q9001 & Q9002	2600 7420	DU #9A	FCI	
	2600 7400	alternate, 2N869		
Q9003 & Q9004	2600 7060	DU #2	FCI	
	2600 7050	alternate 2N915		
Q9005 & Q9006	2600 8630	DU #36	FCI	
	2600 8620	alternate, 2N3114		

RESISTORS

Symbol	Part Number	Description	Recommended Vendor Code	Type
R9001	0229 4890	500K, ±1%	TEX	CD1/2PR
R9002	0229 4700	1M, ±1%	TEX	CD1/2PR
R9003	0229 4900	750K, ±1%	TEX	CD1/2PR
R9004	0229 9040	333K, ±1%	TEX	CD1/2PR
R9006	0229 4910	900K, ±1%	TEX	CD1/2PR
R9007	0229 9050	111K, ±1%	TEX	CD1/2PR
R9008	0229 9010	990K, ±1%	TEX	CD1/2PR
R9009	0229 9080	10.1K, ±1%	TEX	CD1/2PR
R9011	0235 4140	composition, 10, ¼W	ALB	CB
R9012	0236 3260	174K, ±1%	TEX	CD1/2PR
R9013	0229 9290	590K, ±1%	TEX	CD1/2PR
R9014	0105 6060	variable, composition, 50K, ±20%, 1/3W (BAL)	CTS	45
R9016	0234 8690	100K	CGW	C20
R9017	0229 4700	1M, ±1%	TEX	CD1/2PR
R9018	0234 8690	100K	CGW	C20
R9019	0234 8210	1K	CGW	C20
R9021	0203 1650	composition, 100, ±10%	ALB	EB
R9022	0234 8490	15K	CGW	C20
R9023 & R9024	0234 8260	1.6K	CGW	C20
R9026	0237 0940	3K, 2W	CGW	C42S
R9027	0234 8070	270	CGW	C20
R9028	0234 8060	240	CGW	C20
R9029	0107 2935	variable, composition, 4K, ±20%, ¼W (VARIABLE)	ABD	
R9031	0107 3001	variable, composition, 2K, ±20% (CAL)	ABD	
R9032 & R9033	0234 8630	56K	CGW	C20
R9034	0234 8360	4.3K	CGW	C20
R9036 to R9038	0234 8360	4.3K	CGW	C20
R9039	0234 9510	82K, 1W	CGW	C32
R9041	0234 9510	82K, 1W	CGW	C32
R9042	0234 8590	39K	CGW	C20
R9043	0109 0060	variable, composition, 200K, ±20%, ¼W (POSITION)	CTS	45
R9044	0234 8590	39K	CGW	C20
R9046	0234 8690	100K	CGW	C20
R9047 & R9048	0234 8360	4.3K	CGW	C20
R9049	0203 1650	composition, 100, ±10%	ALB	EB
R9051	0203 1650	composition, 100, ±10%	ALB	EB
R9052	0234 8380	5.1K	CGW	C20
R9053	0234 8050	220	CGW	C20
R9054	0228 3860	2.4K, 3W	CGW	LPI-3
R9056	0228 3860	2.4K, 3W	CGW	LPI-3
R9057	0109 1760	variable, wire wound, 1K, ±10%, 4W (DP LEVEL)	CTS	AW
R9059	0230 2130	4.7K, 7W	CGW	LPI-7
R9061	0230 2130	4.7K, 7W	CGW	LPI-7
R9062 & R9063	0237 0930	2.7K, 2W	CGW	C42S
R9064	0234 8310	2.7K	CGW	C20
R9066	0203 1260	composition, 1.8M	ALB	EB
R9067	0203 1200	composition, 1M	ALB	EB
R9068	0203 1230	composition, 1.3M	ALB	EB
R9069	0237 0870	1.5K, 2W	CGW	C42S
R9071	0224 5100	91, 4W	CGW	LPI-4

SWITCHES

Symbol	Part Number	Description	Recommended Vendor Code	Type
S900	0501 7361	rotary, 4 sections, 10 positions (VOLTS/DIV)	ABD	
S901	0503 2500	slide, DPDT (AC/DC)	MUT	4603A2

ELECTRON TUBE

Symbol	Part Number	Description	Recommended Vendor Code	Type
V900	2501 1610	ECC82/12AU7	AMX	

SECTION 6B
SPARE PARTS LIST

SPARE PARTS REQUIREMENTS

a. General

The Type 74-19 Amplifier Plug-in as an extremely reliable and dependable instrument. Only components thoroughly tested and approved by the engineers of the Quality Assurance Department are used in this instrument. Continued performance tests, environmental and life testing of production units make certain your instrument will give many years of satisfactory service. These new Fairchild instruments are precision-engineered and require no selected parts.

Two lists of "running spares" are included to aid you in periodic maintenance. The running-spare parts lists include recommended quantities and reference symbol numbers. Section 6A of this Instruction Manual gives a complete listing of all components and their recommended vendors so that you may readily procure them from a local supply house or your own stores.

Note: The local Fairchild Scientific Instrument Field Engineering representative and his service organization can assist you in obtaining any additional components in the shortest possible time. To help expedite service, always give the Type Number and Serial Number of the instrument; always specify the part number and give a description of the component (see Section 6A of this manual).

b. 500-Hour Spares (6 months)

The recommended list for one through three units is given below.

ELECTRON TUBE

Type	Quantity
V900	1

TRANSISTORS

Type	Quantity
Q9001 (DU #9A)	1
Q9003 (DU #2)	1
Q9005 (DU #36)	1

c. 2000-Hour Spares (2 years)

The recommended list for one through ten units is given below. Maintain spares indicated plus one for each oscilloscope in use; 2 of each set of the 500-hour spare list given in paragraph (b) plus the quantities listed as follows:

CAPACITORS

Symbol	Quantity	Symbol	Quantity
C9001	1	C9019	1
C9002	1	C9022	1
C9003	2	C9023	1
C9011	1	C9026	1
C9016	1	C9027	1
C9017	1	C9028	1
C9018	1	C9029	1

ELECTRICAL CONNECTORS

Symbol	Quantity
J9001	1
J9002	1
P9001	1

COIL

Symbol	Quantity
L9001	1

RESISTORS

R9001	1	R9019	1	R9046	1
R9002	1	R9021	1	R9052	1
R9003	1	R9022	1	R9053	1
R9004	1	R9023	1	R9054	1
R9006	1	R9026	1	R9057	1
R9007	1	R9027	1	R9059	1
R9008	1	R9028	1	R9062	1
R9009	1	R9029	1	R9064	1
R9011	1	R9031	1	R9066	1
R9012	1	R9032	1	R9067	1
R9013	1	R9034	2	R9068	1
R9014	1	R9039	1	R9069	1
R9016	1	R9042	1	R9071	1
R9017	1	R9043	1		
R9018	1	R9044	1		

SWITCHES

Stock only one each of the following switches for each ten units being maintained:

S900 and S901

d. Miscellaneous

The following items may be stocked in quantities of one for each ten units being maintained:

Name	Function	Part Number
Connector, BNC	(Input)	0905 7610
Knob, GP #2	(Volts/Div)	4500 8945
Knob, fastener	——	4501 0431
Knob, small, orange	(Variable)	4501 2091
Knob, small, black	(Position)	4501 2022
Knob, gnd post	——	4501 2191
Nut, knurled	(Bal/Cal)	6103 4051
Panel, front	——	3201 3711
Switch	(AC/DC)	0503 2500

e. Summary

The quantities of spare parts given in the preceding paragraphs are intended for industrial and military duty under normal environment and heavy-use conditions. It is suggested that the maintenance engineer evaluate:

1. The conditions under which the instruments will be used.

2. The skill of the maintenance technicians.

3. Other similar items on hand.

4. The effect of procurement time of spares and effects of instrument down-time on your organization.

It is recommended that inventories of spare parts outlined above be adjusted accordingly to the requirements of your own laboratory or plant.

In the first analysis, the factory recommends the availability of spares or standby equipments since extensive life testing of your instrument has shown no higher failure rate for any specific component.

LIST OF RECOMMENDED VENDORS

CODE	NAME
ABD	Du Mont Laboratories
AER	Aerovox Corporation
AHH	Arrow-Hart & Hegeman Electric Company
ALB	Allen-Bradley Company
ALC	Allied Control
ALCO	Alco Electronic Products
ALD	Alden Products Company
AMA	Amaton Electronic Hardware
AMP	Amp Inc.
AMR	Amperite Company, Inc.
AMX	Amperex Electronics Products, Inc.
APC	American Phenolic Corporation
APH	Amphenol Electronics Corporation
ARC	Arco Electronics Inc. (Elmenco)
AST	Astron Corporation
AUT	Automatic Metal Products Corporation
BEL	Belfuse
BNS	Bourns Inc.
BUR	Burndy Engrg. Company
BUS	Bussmann Mfg. Company
CAN	Cannon Electric Company
CBS	CBS-Hytron Division of CBS
CDE	Cornell-Dubilier Electric Corporation
CGW	Corning Glass Works
CH	Cutler-Hammer, Inc.
CHC	Chester Cable Corporation
CHM	Chatham Electronics
CIN	Cinch Manufacturing Company
CLS	Clarostat Mfg. Co., Inc.
COC	Continental Carbon (Division of Wirt Company)
COM	Comar Electric
COW	Continental-Wirt Electronics Corporation
CPC	C. P. Clare & Company
CRL	Centralab, Division of Globe-Union, Inc.
CST	Chicago Standard Transformer Corporation
CTC	Cambridge Thermionic Corporation
CTS	Chicago Telephone Supply Corporation
CUR	Curtis Instrument
DAG	Dage Electric Company, Inc.
DAL	Dale Products, Inc.
DLC	Dialight Corporation
DRK	Drake Mfg. Company
EBY	Hugh H. Eby, Inc.
EDL	Edal Industries
EIA	Any manufacturer meeting EIA standards
ELC	Electra Manufacturing Company
ELD	Eldema Corporation
ELM	Elmenco
EMC	Electro Motive Mfg. Company
EMW	Elmwood Sensors, Inc.
ERC	Erie Technological Products, Inc.
ESX	Essex Electronics
FAST	John E. Fast Company
FCI	Fairchild Camera and Instrument Corporation
FER	Ferroxcube Corporation of America
GDE	Good-All Electric Mfg. Company
GE	General Electric Company
GEN	General Instrument Corporation
GEP	General Products Corporation
GLB	Globe Industries
GRC	General Radio Company
GRY	Grayhill, Inc.
GUD	The Gudeman Company
HAM	The Hammarlund Manufacturing Co. Inc.

CODE	NAME
HON	Honeywell
HOP	Hopkins Engineering Company
HP	Hewlett-Packard Company
IRC	International Resistance Company
IRP	International Rectifier Corporation
ITT	International Telephone and Telegraph Corporation
JEF	Jeffers Electronics, Inc.
JHN	E. F. Johnson Company
JWM	J. W. Miller Company
KUL	Kulka Electric Mfg. Co. Inc.
KXM	Klixon Metals and Control Corporation
LED	Ledex Inc.
LEE	Leecraft Mfg. Company
LIN	Line Electric
LFI	Littlefuse, Inc.
MAL	P. R. Mallory & Company, Inc.
MCR	Micro Switch (Division of Minneapolis-Honeywell Regulator Co.)
MIC	Micamold Electronics Mfg. Corporation
MIL	Miller Electric Company
MOV	M-O Valve Company Ltd.
MOT	Motorola Semiconductor Products, Inc.
MSW	Micro Switch
MUC	Mucon Corporation
MUL	Mullard Limited
MUT	The Muter Company
NYT	New York Transformer Company, Inc.
OAK	Oak Mfg. Company
PHC	Philco Corporation
PHI	Philips Electronic Tube Division
PLS	Plastoid Corporation
POT	Potter & Brumfield, Inc.
PRC	Precision Resistor Co., Inc.
PYR	Pyramid Electric Company
RCA	Radio Corporation of America
RMC	Radio Materials Corporation
ROY	Royal Electric Corporation, Inc.
RTN	Rotron Mfg. Company
SIG	Signalite Inc.
SIL	Silicon Transistor Corporation
SLT	Sealectro Corporation
SOL	Solitron Devices, Inc.
SPG	Sprague Electric Company
STC	Stackpole Carbon Company
STW	Standard Winding Company
SUM	Summit Coil Company
SWT	Switchcraft Inc.
SWW	Stanwyck Winding Company
SYL	Sylvania Electric Products, Inc.
SYN	Syntronic Instruments, Inc.
TEC	Transistor Electronics Corporation
TEX	Texas Instruments, Inc.
THC	Thermal Control, Inc.
TOR	Torrington Mfg., Company
TRS	Tresco, Inc.
TRU	Tru-Ohm Products
TUG	Tung-Sol Electric Inc.
UCN	Ucinite Company
UTC	United Transformer Company
VIC	The Victoreen Instrument Company
WDE	Wood Electric Corporation
WDL	Ward Leonard Electric Company
WES	Weston Electrical Instrument Corporation
WYN	Welwyn International Inc.

WARRANTY

The Instrumentation Division warrants that each new Cathode-ray Oscilloscope, Automotive Test Equipment, and other Electronic or Electrical Test or Measuring Equipment (hereinafter referred to as "Instrument") manufactured or sold by it, is free from defects in material or workmanship under normal use and service for a period of one year from the date of its sale to the first purchaser for use. If, upon examination by Fairchild, the Instrument is determined to be defective in workmanship or material, Fairchild will, subject to the conditions set forth below, either repair the defective part or replace it with a new part. Fairchild shall not be liable for any delay or failure to furnish a replacement part resulting directly or indirectly from any governmental restriction, priority or allocation or any other governmental regulatory order or action, nor shall Fairchild be liable for damages by reason of the failure of the Instrument to perform properly or for any consequential damages. This warranty does not apply to any Instrument that has been subject to negligence, accident, misuse or improper installation or operation or that in any way has been tampered with, altered or repaired by any person other than an authorized Fairchild service organization or an employee thereof, or to any Instrument whose serial number has been altered, defaced or removed, or to any Instrument purchased within, and thereafter removed beyond, the continental limits of the United States.

This warranty shall, at Fairchild's option, become void unless registration thereof is promptly effected as provided below. This warranty is in lieu of all other warranties, expressed or implied, and no one is authorized to assume any liability on behalf of Fairchild or impose any obligation upon it in connection with the sale of any Instrument, other than as stated above.

REGISTERING THE WARRANTY

To register this warranty, the enclosed warranty registration card must be properly filled out and mailed to the Instrument Service Department immediately upon receipt of the equipment. Complete information is necessary. BOTH THE TYPE NUMBER AND THE SERIAL NUMBER OF THE INSTRUMENT MUST BE GIVEN ON THIS CARD. Instruments must be examined immediately upon receipt, since claims for damage in transit will not be honored by the carrier unless prompt action is taken.

CHANGES IN SPECIFICATIONS

The right is reserved to change the published specifications of equipment at any time and to furnish merchandise in accordance with current specifications without incurring any liability to modify equipment previously sold, or to supply new equipment in accordance with earlier specifications excepting under the classification of special apparatus.

SERVICE

In order to insure service under our warranty, the enclosed warranty service card must be properly filled out and returned to the factory. In all cases where service or adjustment is requested, please first contact the factory or authorized depot, giving complete information concerning the nature of the failure and describing the manner in which the equipment was used when failure occurred. THE TYPE NUMBER AND SERIAL NUMBER of the equipment must also be given. In this way, much time can be saved and unnecessary inconvenience often avoided. When writing to the factory in this respect, address:

Fairchild Camera and Instrument Corp.
Instrumentation Division
50 Somerset Place, Clifton, New Jersey

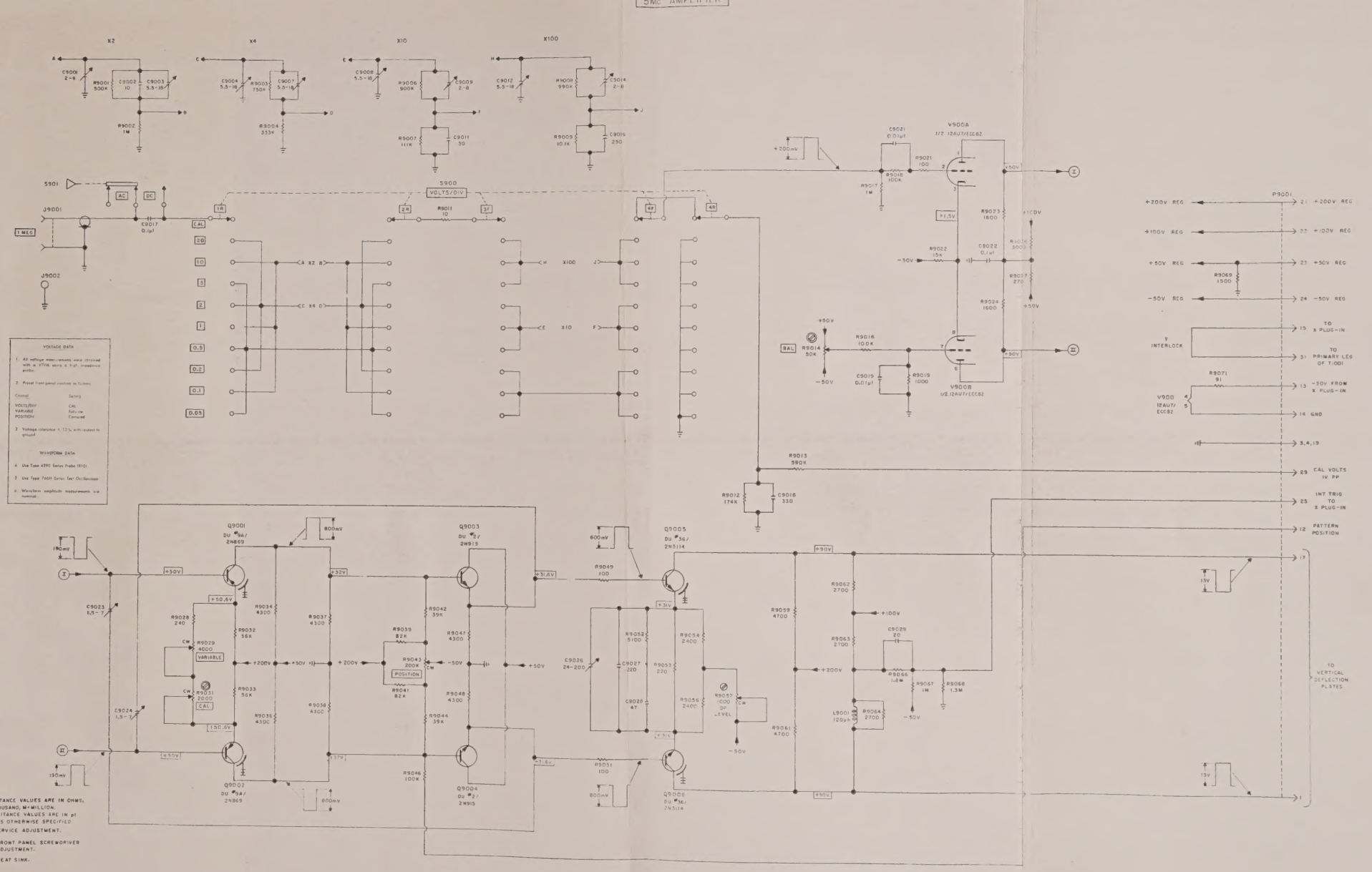
The Instrument Service Department will then send to the customer the written procedure for disposition and shipping instructions. All equipment should be packed and shipped in accordance with this procedure; and identification tags should be attached to each tube or instrument.

REPLACEMENT PARTS

If it is necessary to order a replacement component from the factory, always give the Type number and Serial number of the Instrument. Before ordering parts for in-warranty replacement or purchasing them for out-of-warranty replacement, be sure to consult the Parts List in the Instruction Manual. The Parts List gives the values, tolerances, ratings, and Fairchild part number for all electrical components used in the Instrument. This will help to expedite service.

PATENT NOTICE

Manufactured under one or more U. S. Patents owned or controlled by Fairchild Camera and Instrument Corporation. 50 Somerset Place, Clifton, New Jersey, U.S.A. Patent Numbers supplied upon request.


5 Mc AMPLIFIER
X2
X4
X10
X100
S900
VOLTS/DIV
S901
J9001
J9002
1 MEG
AC
DC
CAL
VOLTAGE DATA
WAVEFORM DATA
V9000A
1/2 12AU7/ECC82
V9000B
1/2 12AU7/ECC82
V900
12AU7/ECC82
P9001
+200V REG
+100V REG
+50V REG
-50V REG
TO X PLUG-IN
TO PRIMARY LEG OF T-001
-50V FROM X PLUG-IN
GND
CAL VOLTS IV PP
INT TRIG TO X PLUG-IN
PATTERN POSITION
TO VERTICAL DEFLECTION PLATES
Q9001
Q9002
Q9003
Q9004
Q9005
Q9006
VARIABLE
POSITION
CAL
BAL
L9001 120μh
NOTES:
1. RESISTANCE VALUES ARE IN OHMS; K=THOUSAND, M=MILLION.
2. CAPACITANCE VALUES ARE IN pf UNLESS OTHERWISE SPECIFIED.
3. SERVICE ADJUSTMENT.
4. FRONT PANEL SCREWDRIVER ADJUSTMENT.
5. HEAT SINK.

ME -4684

FAIRCHILD
AUTHOR

AMPLIFIER
TITLE

74-19

DATE DUE	BORROWER'S NAME	DATE RETURNED

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